Applicant(s): SHEFER et al.
Filing Date: 03/06/2002
Serial No.: 10/091,935
Docket No.: 4686-110 US

EXHIBIT 1

dis•sem•i•nule (dĭ-sĕm′ə-nyo͞ol′) *n.* [DISSEMIN(ATE) + -ULE.] A reproductive plant part, as a seed, fruit, or spore, that is modified for dispersal.

dis•sen•sion (dĭ-sĕn′shən) *n.* [ME *dissencioun* < OFr. *dissension* < Lat. *dissensio* < *dissentire*, to dissent.] A difference of opinion, esp. one that leads to argument or strife.

dis•sent (dĭ-sĕnt′) *vi.* **-sent•ed, -sent•ing, -sents** [ME *dissenten* < Lat. *dissentire* : *dis-*, apart + *sentire*, to feel.] **1.** To differ in opinion or feeling : DISAGREE. **2.** To withhold approval or assent. —*n.* **1.** Difference of opinion or feeling : DISAGREEMENT. **2.** The refusal to conform to the authority, doctrine, or usages of an established church. **3.** A justice's refusal to concur with the opinion of a majority. **—dis•sent′ing•ly** *adv.*

dis•sent•er (dĭ-sĕn′tər) *n.* **1.** One who dissents. **2.** *often* **Dissenter.** One who refuses to accept the authority, doctrine, or usages of an established church, esp. a Protestant who dissents from the Church of England.

dis•sen•tient (dĭ-sĕn′shənt) *adj.* Dissenting, esp. from the policies or sentiment of a majority. —*n.* DISSENTER 1. **—dis•sen′tience** *n.*

dissenting opinion *n. var. of* DISSENT 3.

dis•sen•tious (dĭ-sĕn′shəs) *adj.* Given to dissension.

dis•sep•i•ment (dĭ-sĕp′ə-mənt) *n.* [Lat. *dissaepimentum*, partition < *dissaepire*, to divide : *dis-*, apart + *saepire*, to enclose < *saepes*, fence.] A membranous or calcareous partition between organs or parts : SEPTUM. **—dis•sep′i•men′tal** (-mĕn′tl) *adj.*

dis•ser•tate (dĭs′ər-tāt′) *also* **dis•sert** (dĭ-sûrt′) *vi.* **-tat•ed, -tat•ing, -tates** *also* **-sert•ed, -sert•ing, -serts** [Lat. *dissertare, dissertat-*, freq. of *disserere*, to discuss : *dis-*, apart + *serere*, to connect.] To discourse formally. **—dis′ser•ta′tor** *n.*

dis•ser•ta•tion (dĭs′ər-tā′shən) *n.* A formal, often lengthy treatise or discourse, esp. one written by a candidate for a doctoral degree.

dis•serve (dĭs-sûrv′) *vt.* **-served, -serv•ing, -serves** To mistreat.

dis•ser•vice (dĭs-sûr′vĭs) *n.* A harmful action : INJURY.

dis•sev•er (dĭ-sĕv′ər) *v.* **-ered, -er•ing, -ers** [ME *disseveren* < OFr. *dessevrer* < LLat. *disseparare* : Lat. *dis-*, apart + Lat. *separare*, to separate. —see SEPARATE.] —*vt.* **1.** To cut apart : SEPARATE. **2.** To divide into parts. —*vi.* To become separated or disunited. **—dis•sev′er•ance, dis•sev′er•ment** *n.*

dis•si•dence (dĭs′ĭ-dəns) *n.* Disagreement : dissent.

dis•si•dent (dĭs′ĭ-dənt) *adj.* [Lat. *dissidens, dissident-*, pr.part. of *dissidēre*, to disagree : *dis-*, apart + *sedēre*, to sit.] Disagreeing, as in opinion or belief. —*n.* DISSENTER 1.

dis•sil•i•ent (dĭ-sĭl′ē-ənt) *adj.* [Lat. *dissiliens, dissilient-*, pr.part. of *dissilire*, to burst apart : *dis-*, apart + *salire*, to leap.] Bursting apart, as do some ripe seed pods.

dis•sim•i•lar (dĭ-sĭm′ə-lər) *adj.* Different. **—dis•sim′i•lar•ly** *adv.*

dis•sim•i•lar•i•ty (dĭ-sĭm′ə-lăr′ĭ-tē) *n., pl.* **-ties** **1.** The quality of being unlike : DIFFERENCE. **2.** A point of difference.

dis•sim•i•late (dĭ-sĭm′ə-lāt′) *vt. & vi.* **-lat•ed, -lat•ing, -lates** [DIS- + (AS)SIMILATE.] To make or become dissimilar.

dis•sim•i•la•tion (dĭ-sĭm′ə-lā′shən) *n.* **1.** The act or process of making or becoming dissimilar. **2.** The process by which one of two similar phonemes is displaced or changed by the other; e.g., the English word *pilgrim* is derived from Latin *pelegrinus*, a dissimilated form of *peregrinus*.

dis•si•mil•i•tude (dĭs′ə-mĭl′ĭ-to͞od′, -tyo͞od′) *n.* [ME < Lat. *dissimilitudo* < *dissimilis*, different : *dis-*, not + *similis*, like.] Lack of resemblance : DISSIMILARITY.

dis•sim•u•late (dĭ-sĭm′yə-lāt′) *v.* **-lat•ed, -lat•ing, -lates** [ME *dissimulaten* < Lat. *dissimulare* : *dis-* (reversal) + *simulare*, to simulate.] —*vt.* To conceal (e.g., one's intentions) under a false appearance. —*vi.* To disguise one's true feelings or intentions. **—dis•sim′u•la′tion** *n.* **—dis•sim′u•la′tive** *adj.* **—dis•sim′u•la′tor** *n.*

dis•si•pate (dĭs′ə-pāt′) *v.* **-pat•ed, -pat•ing, -pates** [ME *dissipaten* < Lat. *dissipare*, to disperse : *dis-*, apart + *supare*, to throw.] —*vt.* **1.** To drive away or dispel by or as if by dispersing : SCATTER. **2.** To waste or squander <*dissipated* their inheritance> **3.** To cause to lose (e.g., heat) irreversibly. —*vi.* **1.** To vanish by dispersion. **2.** To disappear by or as if by rising. **3.** To indulge in extravagant pursuit of pleasure : CAROUSE. **—dis′si•pat′er, dis′si•pa′tor** *n.* **—dis′si•pa′tive** *adj.*

dis•si•pat•ed (dĭs′ə-pā′tĭd) *adj.* **1.** Extravagant in the pursuit of pleasure : DISSOLUTE. **2.** Wasted or squandered <a *dissipated* fortune> **—dis′si•pat′ed•ly** *adv.* **—dis′si•pat′ed•ness** *n.*

dis•si•pa•tion (dĭs′ə-pā′shən) *n.* **1.** The act of dissipating or state of being dissipated. **2.** Wasteful expenditure or use. **3.** Dissolute indulgence in pleasure : INTEMPERANCE. **4.** A diversion.

dis•so•cia•ble (dĭ-sō′shə-bəl, -shē-ə-bəl) *adj.* Capable of being dissociated : SEPARABLE. **—dis•so′cia•bil′i•ty, dis•so′cia•ble•ness** *n.* **—dis•so′cia•bly** *adv.*

dis•so•ci•ate (dĭ-sō′shē-āt′, -sē-) *v.* **-at•ed, -at•ing, -ates** [Lat. *dissociare, dissociat-* : *dis-* (reversal) + *sociare*, to unite < *socius*, companion.] —*vt.* **1.** To remove from association : SEPARATE <"Marx never *dissociated* man from his social environment" —Sidney Hook> **2.** *Chem.* To cause to undergo dissociation. —*vi.* **1.** To cease associating : PART. **2.** *Chem.* To undergo dissociation. **—dis•so′ci•a′tive** *adj.*

dis•so•ci•a•tion (dĭ-sō′sē-ā′shən, -shē-) *n.* **1.** The act of dissociating or state of being dissociated. **2.** *Chem.* **a.** The process by which the action of a solvent or a change in physical condition, as in temperature, causes a molecule to split into simpler groups of atoms or ions. **b.** The separation of an electrolyte into ions of opposite charge. **3.** *Psychol.* A defense mechanism in which anxiety-provoking thoughts, emotions, or physical sensations are separated from the rest of the psyche.

dis•sol•u•ble (dĭ-sŏl′yə-bəl) *adj.* [Lat. *dissolubilis* < *dissolvere*, to dissolve.] Capable of being dissolved. **—dis′sol•u•bil′i•ty, dis•sol′u•ble•ness** *n.*

dis•so•lute (dĭs′ə-lo͞ot′) *adj.* [ME < Lat. *dissolutus*, p.part. of *dissolvere*, to dissolve.] Lacking moral restraint : PROFLIGATE. **—dis′so•lute′ly** *adv.* **—dis′so•lute′ness** *n.*

dis•so•lu•tion (dĭs′ə-lo͞o′shən) *n.* **1.** Disintegration into component parts : DECOMPOSITION. **2.** Lack of moral restraint. **3.** Termination or extinction by deconcentration or dispersion. **4.** Death. **5.** Annulment or termination of a formal or legal bond, tie, or contract. **6.** Formal adjournment or dismissal of an assembly or legislature. **7.** Reduction to a liquid form. **—dis′so•lu′tive** *adj.*

dis•solve (dĭ-zŏlv′) *v.* **-solved, -solv•ing, -solves** [ME *dissolven* < Lat. *dissolvere* : *dis-*, apart + *solvere*, to release.] —*vt.* **1.** To cause to pass into solution <*dissolve* instant coffee in water> **2.** To reduce to liquid form : MELT. **3.** To cause to disappear : DISPEL. **4.** To separate into component parts : DISINTEGRATE. **5.** To bring to an end by or as if by breaking up : TERMINATE. **6.** To dismiss (e.g., an assembly or legislature). **7.** To affect emotionally. **8.** To cause to lose definition : BLUR <"Morality has finally been *dissolved* in pity" —Leslie Fiedler> **9.** *Law.* To render null : ABROGATE. —*vi.* **1.** To pass into solution. **2.** To melt. **3.** To disperse or break up. **4.** To become disintegrated. **5.** To be moved emotionally <*dissolved* in tears> **6.** To lose definition or clarity : fade away. **7.** To shift shots in a film or videotape by having one shot fade out while the next simultaneously grows clearer. —*n.* A transition in a film or videotape made by dissolving. **—dis•solv′a•ble** *adj.* **—dis•solv′er** *n.*

dis•sol•vent (dĭ-zŏl′vənt) *n.* A solvent. **—dis•sol′vent** *adj.*

dis•so•nance (dĭs′ə-nəns) *also* **dis•so•nan•cy** (-nən-sē) *n.* **1.** A harsh or unpleasant combination of sounds : DISCORD. **2.** Lack of agreement : CONFLICT. **3.** *Mus.* A combination of tones conventionally held to suggest unrelieved tension and to require resolution.

dis•so•nant (dĭs′ə-nənt) *adj.* [ME *dissonaunt* < OFr. *dissonant* < Lat. *dissonans*, pr.part. of *dissonare*, to be dissonant : *dis-*, apart + *sonare*, to sound.] **1.** Harsh or unpleasant in sound : DISCORDANT. **2.** Disagreeing : conflicting. **3.** *Mus.* Constituting or producing a dissonance. **—dis′so•nant•ly** *adv.*

dis•suade (dĭ-swād′) *vt.* **-suad•ed, -suad•ing, -suades** [Lat. *dissuadēre* : *dis-* (reversal) + *suadēre*, to advise.] To discourage or deter from a course of action or intention by exhortation or persuasion. **—dis•suad′er** *n.*

dis•sua•sion (dĭ-swā′zhən) *n.* [Lat. *dissuasio* < *dissuadēre*, to dissuade.] The act or an instance of dissuading. **—dis•sua′sive** *adj.* **—dis•sua′sive•ly** *adv.* **—dis•sua′sive•ness** *n.*

dis•syl•la•ble (dĭ-sĭl′ə-bəl, dĭs′sĭl-, dī′sĭl′-) *n. var. of* DISYLLABLE.

dis•sym•me•try (dĭs-sĭm′ĭ-trē) *n., pl.* **-tries** Lack of symmetry. **—dis′sym•met′ric** (dĭ′sĭ-mĕt′rĭk), **dis′sym•met′ri•cal** *adj.* **—dis′sym•met′ri•cal•ly** *adv.*

dis•taff (dĭs′tăf′) *n.* [ME *distaf* < OE *distæf* : *dis-*, bunch of flax + *staf*, staff.] **1.** A staff having a cleft end that holds the unspun flax, wool, or tow from which thread is drawn in spinning by hand. **2.** A woman's work and domain. **3.** Women as a group.

distaff side *n.* The maternal branch or female side of a family.

dis•tal (dĭs′təl) *adj.* [DIST(ANT) + -AL.] *Anat.* Located far from the origin or line of attachment, as a bone. **—dis′tal•ly** *adv.*

dis•tance (dĭs′təns) *n.* **1.** The fact or condition of being apart in space or time. **2a.** A nonnegative number designating the magnitude of a path along a straight line or curve. **b.** The length of a line segment joining two points. **c.** The length of the perpendicular from a given point to a given line. **3.** The interval separating two specified instants in time. **4.** The extent of space between points on a linear measured course. **5a.** The degree of deviation or difference that separates two things in relationship <the *distance* between liberal and conservative> **b.** The degree of progress between two points in course or trend. **6.** A stretch of linear space without definite limits. **7.** A point removed in space or time. **8.** Aloofness of manner. SERVE. —*vt.* **-tanced, -tanc•ing, -tanc•es** **1.** To place or keep at a distance. **2.** To cause to appear at a distance. **3.** To leave far behind OUTSTRIP.

dis•tant (dĭs′tənt) *adj.* [ME *distaunt* < OFr. < Lat. *distans*, pr.part. of *distare*, to be remote : *dis-*, apart + *stare*, to stand.] **1.** Apart or separate in space or time. **2.** Far removed in space or time <the *distant* future> **3.** Located at, coming from, or going to a distance <*distant* travels> **4.** Remotely related <a *distant* cousin> **5.** Of or relating to mental distance or absent-mindedness <a *distant* reverie> **6.** Reserved in manner : ALOOF. **—dis′tant•ly** *adv.*

dis•taste (dĭs-tāst′) *n.* Dislike or aversion. —*vt.* **-tast•ed, -tast•ing, -tastes** *Archaic.* **1.** To feel repugnance for. **2.** To offend.

dis•taste•ful (dĭs-tāst′fəl) *adj.* **1a.** Disagreeable or unpleasant <the *tasteful* job of laying off workers> **b.** Objectionable or offensive <*distasteful* magazines> **2.** Expressing distaste <a *distasteful* glance> **—dis•taste′ful•ly** *adv.* **—dis•taste′ful•ness** *n.*

dis•tem•per[1] (dĭs-tĕm′pər) *n.* [ME *distemperen*, to upset of the humors < OFr. *destemprer* < Med. Lat. *distemperare* : *dis-* (reversal) + Lat. *temperare*, to temper.] **1a.** An infectious disease occurring in certain mammals, esp. dogs, marked by appetite, a catarrhal discharge from the eyes and nose, partial paralysis and death. **b.** Any of various similar infectious diseases. **2.** Bad temper : PEEVISHNESS. **3.** Social or political disorder. —*vt.* **-pered, -per•ing, -pers** To upset.

dis•tem•per[2] (dĭs-tĕm′pər) *n.* [ME *distemperen*, to dilute < *distemperare*. —see DISTEMPER[1].] **1a.** A process of painting in which pigments are mixed with water and a glue-size or casein binder for flat wall decoration or for scenic and poster painting. **b.** The paint used in distemper. **2.** A painting done in distemper. **—dis•tem′per•er, -per•ing, -pers** **1.** To mix (powdered pigments or color) with glue and size. **2.** To paint in distemper.

dis•tend (dĭ-stĕnd′) *v.* **-tend•ed, -tend•ing, -tends** [ME *distenden* < Lat. *distendere* : *dis-*, apart + *tendere*, to stretch.] —*vt.* To expand from or as if from internal pressure. —*vi.* **1.** To expand by or as if by internal pressure : DILATE. **2.** To stretch in all directions : EXTEND.

dis•ten•si•ble (dĭ-stĕn′sə-bəl) *adj.* Capable of being distended. **—dis•ten′si•bil′i•ty** *n.*

dis•ten•tion *also* **dis•ten•sion** (dĭ-stĕn′shən) *n.* [ME *distentio* < Lat. *distentus*, p.part. of *distendere*, to distend] distending or state of being distended.

dis•tich (dĭs′tĭk) *n., pl.* **-tichs** [Lat. *distichon* < Gk. *distikhos*, having two rows or verses : *di-*, two + *stikhos*, verse.] A verse couplet, esp. one used in a Latin or Greek poem.

dis•ti•chous (dĭs′tĭ-kəs) *adj.* [LLat. *distichus*, having two rows < Gk. *distikhos*. —see DISTICH.] Arranged in two vertical rows on opposite sides of an axis. —Used of leaves. **—dis′ti•chous•ly** *adv.*

dis•til (dĭ-stĭl′) *v. Chiefly Brit. var. of* DISTILL.

dis•till (dĭ-stĭl′) *v.* **-tilled, -till•ing, -tills** [ME *distillen* < Lat. *destillare*, to trickle : *de-*, down + *stillare*, to drip] —*vt.* **1.** To subject (a substance) to distillation. **2.** To tillate) by distillation. **3.** To refine or purify by or a tion. **4.** To separate or extract the essence of <*distill* of a film> **5.** To exude or give off in drops. —*vi.* **1.** To produced by distillation. **2.** To fall or exude in dro **ble** *adj.*

dis•til•late (dĭs′tə-lāt′, -lĭt, dĭ-stĭl′ĭt) *n.* **1.** The liquid vapor in distillation. **2.** An essence or purified form

dis•til•la•tion (dĭs′tə-lā′shən) *n.* **1.** Any of various heat esses used to purify or separate a fraction of a rela mixture or substance, esp. the vaporization of a liqu subsequent collection of components by differential densation. **2.** A distillate.

distillation column *n.* A tall cylindrical metal shell inter perforated horizontal plates used to promote sep cible liquids ascending in the shell as vapor.

dis•till•er (dĭ-stĭl′ər) *n.* **1.** One that distills, as a conde of alcoholic liquors by distillation.

dis•till•er•y (dĭ-stĭl′ə-rē) *n., pl.* **-ies** A plant or establi tilling, esp. alcoholic liquors.

dis•tinct (dĭ-stĭngkt′) *adj.* [ME < OFr. < Lat. *distin distinguere*, to distinguish.] **1.** Distinguished from a VIDUAL <met us on three *distinct* days> ***usage:*** Some if it is sharply distinguished or set apart from othe acteristic or property is *distinctive* if it enables us to thing from another. **2.** Easily perceived : CLEAR <a *dis* **3.** Unquestionable : decided <a *distinct* drawback> PROBABLE <a *distinct* chance of rain> **5.** Marked by TABLE <a *distinct* achievement> **—dis•tinct′ly** *adv.* –

dis•tinc•tion (dĭ-stĭngk′shən) *n.* **1.** The act of distingu ENTIATION. **2.** The condition or fact of being diss ENCE. **3.** A distinguishing factor, attribute, or ch Excellence or eminence, as of performance, chara tion. **b.** A special feature or quality conferring supe **5.** Recognition of achievement or superiority : HONO country with *distinction*>

dis•tinc•tive (dĭ-stĭngk′tĭv) *adj.* **1.** Serving to identify c TINGUISHING <*distinctive* cattle brands> **2.** Charact <*distinctive* regional cuisine> **3.** Phonemically relev of conveying a difference in meaning, as the voici consonant of *bit* compared to *pit*. **—dis•tinc′tiv tinc′tive•ness** *n.*

dis•tin•gué (dĕs′tăng-gā′, dis′-, dĭ-stăng′gā) *adj.* distinguer, to distinguish < OFr.] Distinguished in a ner, or demeanor.

dis•tin•guish (dĭ-stĭng′gwĭsh) *v.* **-guished, -guish•ing,** distinguen < OFr. *distinguer* < Lat. *distinguere*, to **1.** To recognize as being different or distinct. **2a.** tinctly <*distinguish* a light in the window> **b.** To pi <*distinguished* my child's voice in the chorus> **3a.** different categories. **b.** To make noticeable : SET AI

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ISBN-13: 978-0-618-39601-6
ISBN-10: 0-618-39601-2

Library of Congress Cataloging-in-Publication Data

Webster's II new college dictionary. -- 3rd ed.
p. cm.
ISBN 0-618-39601-2
1. English language--Dictionaries. I. Title: Webster's two new college dictionary. II. Title: Webster's 2 new college dictionary.
PE1628.W55164 2005
423--dc22

2003057079

Manufactured in the United States of America

Illustration credits: Academy Artworks; Alan Witschonke; Carlyn Iverson; Cecile Duray-Bito; Chris Costello; Elizabeth Morales; Gail Piazza; Jerry Malone; Laurel Cook Lhowe; Library of Congress; Mapping Specialists, Ltd.; Office of Information, Dept. of the Navy, Washington, DC; Precision Graphics; Tech-Graphics

Applicant(s): SHEFER et al.
Filing Date: 03/06/2002
Serial No.: 10/091,935
Docket No.: 4686-110 US

EXHIBIT 2

TEXTBOOK OF POLYMER SCIENCE

THIRD EDITION

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A Wiley-Interscience Publication

John Wiley & Sons

New York • Chichester • Brisbane • Toronto • Singapore

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Library of Congress Cataloging in Publication Data:

Billmeyer, Fred W.
Textbook of polymer science.

Includes bibliographies and indexes.
1. Polymers and polymerization. I. Title.

QD381.B52 1984 668.9 83-19870
ISBN 0-471-03196-8

Printed in the United States of America

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CHAPTER SEVEN

POLYMER SOLUTIONS

A. CRITERIA FOR POLYMER SOLUBILITY

The Solution Process. Dissolving a polymer is a slow process that occurs in two stages. First, solvent molecules slowly diffuse into the polymer to produce a swollen gel. This may be all that happens—if, for example, the polymer–polymer intermolecular forces are high because of crosslinking, crystallinity, or strong hydrogen bonding. But if these forces can be overcome by the introduction of strong polymer–solvent interactions, the second stage of solution can take place. Here the gel gradually disintegrates into a true solution. Only this stage can be materially speeded by agitation. Even so, the solution process can be quite slow (days or weeks) for materials of very high molecular weight.

Polymer Texture and Solubility. Solubility relations in polymer systems are more complex than those among low-molecular-weight compounds, because of the size differences between polymer and solvent molecules, the viscosity of the system, and the effects of the texture and molecular weight of the polymer. In turn, the presence or absence of solubility as conditions (such as the nature of the solvent, or the temperature) are varied can give much information about the polymer; this is in fact the topic of most of this chapter.

From what has already been said, it is clear that the topology of the polymer is highly important in determining its solubility. Crosslinked polymers do not dissolve, but only swell if indeed they interact with the solvent at all. In part, at least, the degree of this interaction is determined by the extent of crosslinking: Lightly crosslinked rubbers swell extensively in solvents in which the unvulcanized material would dissolve, but hard rubbers, like many thermosetting resins, may not swell appreciably in contact with any solvent.

The absence of solubility does not imply crosslinking, however. Other features may give rise to sufficiently high intermolecular forces to prevent solubility. The presence of crystallinity is the common example. Many crystalline polymers, particularly nonpolar ones, do not dissolve except at temperatures near their crystalline melting points. Because crystallinity decreases as the melting point is approached (Chapter 10) and the melting point is itself depressed by the presence of the solvent, solubility can often be achieved at temperatures significantly below the melting point. Thus linear polyethylene, with crystalline melting point $T_m = 135°C$, is soluble in many liquids at temperatures above 100°C, while even polytetrafluoroethylene, $T_m = 325°C$, is soluble in some of the few liquids that exist above 300°C. More polar crystalline polymers, such as 66-nylon, $T_m = 265°C$, can dissolve at room temperature in solvents that interact strongly with them (for example, to form hydrogen bonds).

There is little quantitative information about the influence of branching on solubility; in general, branched species appear to be more readily soluble than their linear counterparts of the same chemical type and molecular weight.

Of all these systems, the theory of solubility, based on the thermodynamics of polymer solutions, is highly developed only for linear polymers in the absence of crystallinity. This theory is described in Sections *C* and *D*. Here the chemical nature of the polymer is by far the most important determinant of solubility, as is elucidated in the remainder of this section. The influence of molecular weight (within the polymer range) is far less, but it is of great importance to fractionation processes (Sections *D* and *E*), which yield information about the distribution of molecular weights in polymer samples.

Solubility Parameters. Solubility occurs when the free energy of mixing

$$\Delta G = \Delta H - T\Delta S$$

is negative. It was long thought that the entropy of mixing ΔS was always positive, and therefore the sign of ΔG was determined by the sign and magnitude of the heat of mixing ΔH. For reasonably nonpolar molecules and in the absence of hydrogen bonding, ΔH is positive and was assumed to be the same as that derived for the mixing of small molecules. For this case, the heat of mixing per unit volume can be approximated (Hildebrand 1950) as

$$\Delta H = v_1 v_2 (\delta_1 - \delta_2)^2$$

where v is volume fraction and subscripts 1 and 2 refer to solvent and polymer, respectively. The quantity δ^2 is the cohesive energy density or, for small molecules, the energy of vaporization per unit volume. The quantity δ is known as the *solubility parameter*. (This expression for the heat of mixing is one of several alternatives used in theories of the thermodynamics of polymer solutions; in Section *C*, ΔH is written in a different but equivalent way.)

The value of the solubility-parameter approach is that δ can be calculated for both polymer and solvent. As a first approximation, and in the absence of strong